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Subject Note Book X L V I

Instructor

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Ecology is application of idea of "the field" (of force) to life.

There is surely a Fall, need not be a catastrophe but must be a limit, a point of latent growth & then a crisis or limit.

Kampfstoffe envy or O as starting of life. not so. Used manganese instead. Then CO_2 ails.

Notes from Cremer's Biblico Theological Lexicon of New Testament Greek. Edinburgh, 1878
(continued from many previous notebooks XLV) Re

p. 154 γινώσκω "In N.T. Greek γινώσκειν frequently denotes a personal relation between the person knowing and the object known, equivalent to, to be influenced by our knowledge of an object, to suffer oneself to be determined thereby; for anything is known only so far as it is of importance to the person knowing and has an influence on him, and thus a personal relationship is established between the knowing subject and the object known. [examples] . ... But usually the more formal

meaning, to have understanding of, prevails. ---

"A further particularizing of that use of the word occurs in the writings of St. John. Not only is a rightly adjusted relation (not merely conduct) toward God and his revelation there brought into connection with the knowledge thereof, as in John VI 69, 1 John IV 16 ---- but that relation itself is opposed by the word γινώσκειν, upon the supposition that this involves the subject's entering into a true relation to the object. See John I 10, 11: --- In order to understand the several expressions, two things must be kept in view, viz. that γινώσκειν has to do both with the significance of the object known for the subject knowing, and at the same time, with the influence of the object on the subject. (John XVII 3, 25; I 10; VIII 55. This is especially clear in 1 John II 20; 1 John IV 6. ---- Thus the relation of the Christian life is represented as the spontaneous fruit of this knowledge. 1 John III. 6; IV 7, 8; II 3.

"Almost without analogy in classical

Greek (yet γνωστός, known to, befriended), but in keeping with the meaning already given, and anticipated in the corresponding use of the Hebrew יָדַע; is that pregnant saying in Matt VII 23 ["Then I will profess unto them I never knew you, depart from me, ye that work iniquity] οὐδέποτε ἔγνων ὑμᾶς; John X 14 ["I am the good shepherd and know my sheep, and am known of mine" 25 "the works that I do in my father's name, they bear witness of me" 38 "that ye may know and believe that the father is in me, and I in him"]; verse 27 [my sheep hear my voice and I know them]; 1 Cor VIII 3; Gal IV 9; Phil III 10; 2 Tim II 19; 2 Cor V 21. See οἶδα. It is clear that the negative assertion of Matt VII 23 denies any, even the remotest, connection with the object, cf. Matt XXVI 72, οὐκ οἶδα τὸν ἄνθρωπον [Peter's 3d denial of X]; because the necessary condition of such connection, viz. acquaintance, is denied. Cf. 2 Cor. V 21, τὸν μὴ γνόντα ἁμαρτίαν. It is, as we say, to have no inkling, no idea of a thing, to know nothing about it. See Rom VII 7, 8; Matt XXIV 50; Rev III 3. In all these passages we have the denial not merely of a close and special, but of any relation whatever to the object. The

positive γινώσκειν τινά affirms, on the contrary, that the basis of union, and therefore the union itself, exists, and that the object is not strange or foreign to the subject. (The use of the expression to denote sexual intercourse, occurring often in the O.T., in classical Greek in Plut., in the N.T.: Matt I 25, Luke I 34, is quite in keeping with this; of especially Luke I 34).

Ibid pp. 229-230

Εἰδω, obsolete root (Latin video; German wissen) of ἔϊδον and οἶδα = to perceive, to become aware of, εἴδομαι, to appear; with the dative, to be like.

I Ἔϊδον forms the 2d aorist of ὁράω, to see ---- All these expressions have the general meaning - to be specified by the context - to become aware of, to perceive ---; the object presents itself to and for the subject. ----

II. Οἶδα, infinitive εἰδέναι, pluperfect ᾔδειν strictly = to have perceived; hence to have

knowledge of, to know, to be acquainted with. So far as this word here comes under consideration, the usage of the N.T. presents few peculiarities. Between it and its synonym γινώσκειν there is merely the difference that the latter implies an active relation to it, a self-reference of the knower to the object of his knowledge; whereas in the case of εἰδέναι the object has simply come within the sphere of perception, within the knower's circle of vision. When εἰδέναι is employed, therefore, a relation of the object to the subject is in question, and the emphatic οὐκ οἶδα ὑμᾶς in Matt XXV 12 (End of parable of nine virgins ... "But he answered and said Verily I say unto you, I know you not") denotes you stand in no relation to me; whereas the words used in VII 23 οὐδέποτε ἔγνων ὑμᾶς, cf verse 21, 22 = I have never been in connection with you; cf Rom VII 7, with 2 Cor V 21. So also cf 2 Thess I 8, 1 Thess IV 5; Tit I 6 with Rom I 21." ----

Apropos of the frequently repeated idea that since the publication of Einstein's work everything has been proved to be relative and there is no longer any Absolute there are in Einstein's theory two constants or invariants, the gravitational constant and the velocity of light. According to Eddington there are two others. One of these is the so-called "cosmical number" N, which is the total number of protons and electrons in the universe. It amounts to $2 \times 136 \times 2^{256}$. (See his "Philosophy of Physical Science" p 176. The fourth constant is given in his other book "Space, Time & Gravitation", Planck's constant.

(this is the last
sheet that will
belong
to me. ring)

For my own part, I have regarded relativity as a new outlook whose consequences must gradually unfold themselves, rather than as a particular axiom or hypothesis to be translated once for all into definite formulation.

Perhaps the nearest approach to a formulation of the principle is the statement that we observe only relations between physical entities. ~~Because as soon as we ask the question,~~

This requires a certain amount of critical explanation which I shall not enter on now. For, as I have said, I would rather identify relativity with the outlook which leads to this conclusion. I would emphasize

the question "What is it we really observe?" rather than the answer. "We only observe relations between physical "entities." Because as soon as we ask the question, the classical scheme of physics is a punctured bubble; and we start on a path of revolution of which perhaps the end is not yet in sight. It is common to describe the state of theoretical physics in the last thirty years as a succession of revolutions; but it is all one revolutionary movement which was started by this simple question. Heisenberg repeated the question in 1925: "What is it we really observe in an atom?" The result was the new quantum mechanics."

Ibid p. 85

"I have been continually emphasizing the subjectivity of the universe described in physical science. But, you may ask, was it not the boast of the theory of relativity that it penetrated beyond the relative (subjective) aspect of phenomena and dealt with the absolute? For example, it showed that the usual separation of space and time is subjective, being dependent on the observer's motion, and it substituted a four-dimensional space-time independent of the observer. It may seem difficult to reconcile this view of Einstein's theory as lifting the veil of relativity which hides the absolute from us, with my present account of modern physics as acquiescing in, and making the best of, a partially subjective universe.

"It is necessary to remember that

(1934)

there has been thirty years' progress. Relativity began like a new broom, sweeping away all the subjectivity it ~~could find~~ found. But, as we have advanced, other influences of subjectivity have been detected which are not so easily eliminated. Probability, in particular, is frankly subjective, being relative to the knowledge which we happen to possess. Instead of being swept away, it has been exalted by wave mechanics into the main theme of physical law.

"The subjectivity referred to in these lectures is that which arises from the sensory and intellectual equipment of the observer. Without varying this equipment he can vary in position, velocity and acceleration. Such variations will produce

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subjective changes in the appearance of the universe to him; in particular the changes depending on his velocity and acceleration are

more subtle than were realized in classical theory. Relativity theory allows us to remove (if we wish) the subjective effects of the personal characteristics of the observer; but it does not remove the subjective effects of generic characteristics common to all 'good' observers - although it has helped to bring them to light."

— — —

Ibid pp. 56-7

"I do not see how anyone who accepts the theory of relativity can dispute that there has been some replacement of physical hypotheses by epistemological principles; nor do I think that those who accept the theory with understanding will be inclined to dispute it. The more controversial question is 'How far can this replacement extend?' Here my conclusion, based on merely scientific investigation is much more drastic than that of most of my colleagues. I believe that the

whole system of fundamental hypotheses can be replaced by epistemological principles. Or to put it equivalently, all the laws of nature that are usually classed as fundamental can be foreseen wholly from epistemological considerations. They correspond to a priori knowledge, and are therefore wholly subjective.

[This includes all the four constants of the system obs.

The foregoing notes from Eddington are interesting, applicable to Ames' work. It also is epistemological; it also asks the question, What do we really observe? R.V.S.

Notes from an Essay on Sympleges

by A. K. Coomaraswamy in "Studies & Essays in the History of Science & Learning offered in Homage to Geo. Sarton on the occasion of his 60th Birthday 31 August 1944. Ed. by M. F. Ashley-Montagu, Henry Schuman, New York, 1946, pp 465-501. 485

p. 486.

... "The Way is always a 'middle Way,' or as Boethius expresses it, 'Truth - a mean between contrary heresies' (Contra Eutychen VII).

"It remains only to consider the full doctrinal significance of the Sympleges. What the formula states literally is that whoever would transfer from this to the ~~otherworld~~ Otherworld, or return, must do so through the indimensional and timeless 'interval' that divides and at once contrary forces, between which, if one is to pass at all, it must be 'instantly'. The passage

is, of course, that which is also called the 'strait gate' and the 'needle's eye'. What are these contraries, of which the operation is 'automatic'? We have already seen that the antithesis may be of Fear and Hope, or North and South, or ~~Day and Night~~ Night and Day. These are but particular cases of the polarity that necessarily characterizes any 'conditioned' world. A 'world' without pairs of opposites, good and evil, pleasure and pain, love and hate, man and fox, thick and thin, male and female, positive and negative, 'all these pairs' (sarvāṃ dvandvāṃ, Kaivalya Up. I. 4, cf. Philo, Heres 132, -07-214) - would be an 'unconditioned world', a world without accidents, change or becoming, logically inconceivable and of which experience would be impossible.

"It is, then, passing from these 'pairs' that liberation must be won, from

their conflict that we must escape, if we are to be freed from our mortality and to be as and when we will: if, in other words, we are to reach the Further Shore and Otherworld 'where everywhere and every when are focussed', 'for it is not in space, nor hath it poles' (Paradiso XXIX. 22 and XXII. 67). Here, under the Sun, we are overcome by the 'pairs' (Maitri Upa. III. 1): here 'every being in the enmortal-world moves deluded by the mirage of the contrary-pairs, of which the origin is in our liking and disliking ... but to those who are freed from this delusion of the pairs (dvandva-moha-nirmuktāh) ... freed from the pairs that are implied by the expression 'weal and woe' (duravaan vimuktāh sukha-dukkha-samjñaih), these reach the place of invariability' (padam avyayam, Bhagavad-Gītā VII. 27. 28 and XV. 5), i.e. the place of their coming together or coincidence (samaya), through their

midst or in between (*sammǽra*) them.

"It is then, deeply significant that, in the Greenland saga, the Hero, on his way to the Otherworld in which he finds his 'dead' and 'living', cannot circumvent the paired beings (which are the 'lions in his path'), for they 'always get ahead of him' however far he goes to either side. It is inevitably so, because the contraries are of indefinite extension, and even if we could suppose an equally indefinite journey to the point at which 'opposites meet', this would still be a meeting place of both ~~them~~ pheneus, and there would be no way through to a beyond or a within except at this meeting point; a cardinal 'point' that has no fixed position, since the distinction of the correlated members of any pair of contrary qualities (e.g. Long and Short) is only to be formed when we actually make it; and

without extent, seeing that it is one and the same 'limit' that simultaneously unites and divides the contraries of which it is no part, - 'strait is the gate, and narrow is the way, which leadeth unto life, and few there be that find it' (Matthew VII .14). It is for the same reason that the passage must be made so 'suddenly'; it is from the world of time (i.e. past and future) to an eternal Now, and between these two worlds, temporal and timeless, there can be no possible contact but in the 'moment without duration' that for us divides the past from the future, but for the Immortals includes all times.

"The 'moment' has come at last to understand the poignant words of Nicolas of Cusa in the De visione Dei (ch IX. fin.) 'the wall of the Paradise in which They, Sons, dwellest, is built of coincidentia contradictions, nor is there any way to enter

but for one who has overcome the Evil
488 Spirit of Reason who guards the gate',
and to recall the promise, 'To him
that overcometh will I give to eat
the Tree of Life, which is in the midst
of the Paradise of God' (Revelation of
St. John, II. 7 (xx)). In this doctrine and
assurance are reaffirmed what has
always been the dogmatic significance of the
Symplegades and of the Hero's Quest,
'I am the Door', and 'No one cometh
to the Father but by Me.' "

472. ---- "Commonly, for those who are already
in Time and would be liberated, would
s'eternar. Day and Night are as it
were two impassible revolving Seas
or wandering Pillars, and one should
not perform the Agnihotra (Sacrifice
of the Burnt-Offering) either by Day
or by Night but only at dusk after

must end before dark, and at dawn after dark and before sunrise (Jaiminiya Brāhmaṇa, I. 5)

4:13 "Thus the Way 'to break out of the universe (Hermes Trismegistos, Lib. XI. c.9, see note 46) into that other order of the Divine Darkness that Dionysius describes as 'blinding by excess of light' and where the Darkness and the Light 'stand not distant from one another, but together in one another (Jacob Boehme, Three Principles, XIV. 78) is the single track and 'strait' way' that penetrates the cardinal 'point' on which the contraries turn; their unity is only to be reached by entering in there where they actually coincide. And that is, in the last analysis, not any where or when, but within you; 'World's End is not to be [illegible] by walking', but it is within this very fathom-long 'body that the pilgrimage must be made' (Saiyutta Nikāya

I. 62), –

'Our soul is, as it were, the day, and our body the night,
We, in the middle, are the dawn between our day and night'

(Sharh-i-Tabriz, Tabriz ed., 252.12, cited by Nicholson p. 239) ----

476-7 --- "It is a highly characteristic feature of the 'Active Don' that whoever or whatever passes through it must do so with all speed and suddenly, and even so may be docked of its 'tail'; which tail may be, in the examples already considered, either the stern point of a boat, or one of two walkers, or if there is a flock of birds (doves of Zeus or Eskimo geese) then the last of the line; or if the Hero wins through, his pursuer may be caught. Striking examples of these features may be cited in the widely diffused art and

folk-tale motif of the 'Hare and the Hounds'.

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478 "Whoever seeks to interpret myths in a purely rationalistic way, and considers the story of the Hare by itself, might argue that it represents no more than an aetiological myth of popular origin. But actually, that such myths are transmitted, it may be for thousands of years, by the folk to whom they have been entrusted, is no proof of their popular origin; it is in quite another sense than this that Vox populi vox Dei. ----

479 ---- "It should be superfluous to emphasize that the traditional symbols are never the inventions of the particular authors in whom we happen to find them: 'the myth is not my own, I had it from my mother' Euripides in these words, shows that he knew better than such naive scholars as Sir J. J. Frazer and A.A. Macdonell, of whom the former saw in the theme of the

Clashing Rocks 'a mere creation of the story-tellers' fancy' and the latter as the related and almost equally widely distributed motif of the Fallen Feather 'probably a mere embellishment added by the individual poet'! Our scholars who think of myths as having been invented by 'literary men' overlook that the traditional motifs and traditional themes are inseparably connected. The traditional narrator's figures, which he has not invented but has received and faithfully transmitted, are never figures of speech, but always figures of thought; and one cannot ask, which came first, the symbol or its significance, the myth or its ritual enactment. Nor can anything be called a _source_ of folklore, but only a collection of data, that considers only the formulae and not their doctrine, 'que s'arrondit sotto il velame dei versi strani'. The materials collected even in the

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present short article should suffice to convince the reader that, as the late Sir Arthur Evans once wrote, 'The coincidences of tradition are beyond the scope of accident'."

Quotes from a paper on "Analogy in the History of Science" by Agnes Arber in the fulcrum for George Sarton from which the preceding quotation was taken (see p. 13 above)

p. 221

"In our mental armoury, one of the most essential weapons is the perception of likeness or similitude. The recognition of resemblance is indeed the basis of all the classifications by means of which the mind contrives to bring the world of phenomena within its scope. Moreover this form of apprehension lies at the root of all abstract thought

This mind arrives at general ideas by assembling similar phenomena, and making classes to concepts or 'universals', of which the phenomena are individual expressions. In scientific thought, especially, the perception of likeness and unlikeness holds a unique place. It is perhaps the most indispensable of all clues for unravelling problems of widely differing type. The doctrine of probability, for example, can be established without its help. As Bertha wrote, "The only scientific method, that which chiefly constitutes probability is apparent in the bit and every, of like with, or time and; like it or dislike, in the Evidence, more or less of its Circumstances. For when we determine a thing to be probably true ..... 'tis from the mind's resulting in it a likeness to some

other event, which we have observed have come to pass.' (J. Butler, The Analogy of Religion, Natural and Revealed, to the Constitution and Course of Nature, London, 1736, 'Introduction', p. iii). Though Butler's special emphasis on analogy and probability was all his own, cognate ideas can be traced back to classical times. Plato set precedent for this by resemblance and the 'likely', holding, as he did, that the visible world is 'a changing image or likeness (eikon) of an eternal model ... The inference – that no account that we or anyone else can give of it will ever be more than 'likely'. (F. M. Cornford, Plato's Cosmology. The Timaeus of Plato translated, London, 1937, pp. 23-24). This implies an inevitable relativity in all accounts of the universe, and the man of science whose sympathies are with Plato, will feel that he can be on sure ground only when his work

takes the form of <u>comparative</u> study within
the framework of some 'ideal' account, for
which no absolute validity is claimed.
A typical stance is summed up in D'Arcy
Thompson's aphorism: 'Newton did not
show the cause of the apple falling, but
he showed a similitude between the
apple and the stars'. Though it is true
that few research workers of the Western
world have been disposed consciously to
relate their basic notions to the Platonic
view, yet it is equally true that they
have in actual fact followed lines laid
down by Plato, when they have estab-
lished those branches of study which
are, in essence, comparative. In biology
the necessity for the comparative method
has long been realized. - - -

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"To a great extent biological 'explana-
tion' is in fact description, and all
description is basically comparative.
This relativity may be concealed by
the introduction of units of measurement;

but when traced to their origins, these prove to be themselves comparative. The comparative method is indeed inescapable, but its value is liable to be ~~misunderstood~~ underestimated, not because of any flaw genuinely inherent in its structure, but because of the abuses to which it
225 is prone. --- One frequent abuse is the tendency for comparisons – especially those which may true only under some special thought-aspect – to become well-worn clichés. ---

"A much subtler, and therefore more insidious defect in the use of comparison arises out of the very structure of language. Running through both spoken and written thought there is a linear time sequence, which gives a certain significance to the order of words. When we say, 'The portrait is like the sitter' there is no doubt as to which term is the standard of comparison; but even if we

merely say, 'A is like B', the order of the words carries a certain implication that it is B which is the standard to which the comparison is referred. This difficulty may be avoided to some extent by saying 'A and B are alike', instead of 'A is like B'. We need, indeed, to bear constantly in mind the distinction between irreversible comparisons, in which one term is definitely the standard, and reversible comparisons, which are applicable equally in either direction. Thus ---

"Modern definitions of science tend to shun the word 'explanation', and to speak rather of 'tracing relationships between phenomena' (H. Dingle, Through Science to Philosophy, Oxford, 1937, p. 26); such tracing of relations carries us beyond mere similitude and resemblance to the fuller concept of analogy. The word analogy (ἀναλογία) has been used in

every variety of signification, down to simple similitude, so it has become a tempting word for each scientist to redefine in his own way; but it seems best always to bear in mind its original meaning of proportion, which is also one of the meanings of λόγος. It is thus limited to cases in which resemblances of relations, rather than similarity pure and simple, is the point to be emphasized. It is upon the argument from analogy, in this relational sense, that the whole of science has been built up. Only a few of the countless phenomena in the universe can actually be observed, and reliance must, in the last resort, be placed upon the belief that the relations which we are debarred from observing are analogous to those in the field which is open to our perception; without analogy, no widely applicable

laws could ever be formulated."

--- [In modern science analogy is chiefly used in suggesting explanations and for illustration or exposition. It plays little part now in actual scientific reasoning.] --

p. 133 [On analogies] "It is this very imperfection which sets them in the boundary region of scientific thought, where they can act as connecting links with other worlds of experience. --- To understand and use analogies aright, we must realize that they are in their nature artistic and creative rather than analytical and logical, and that their function is to illustrate, to suggest, and to illuminate,

rather than to prove

Re Math. Analogy is like metaphor and simile in poetry. Also like similarity of figures in geometry also a bit like symmetry. (Cf. Scott Buchanan "Poetry & Mathematics"). And if the relation is complete you have equality or identity. Statements of equality in the form of equations are a large part of algebra, trig, calculus and math analysis in general. An equation is an intellectual mode of measurement, a comparison with known quantities like weighing in a balance scale.

Chap 21

- "I found that it is better to [illegible]
[illegible] for a good man to fall into his hands,
than to take up his lot in his pride and
fancied security. I found that he that will
be a true [illegible] must be willing
to be nothing but a door of the
work, & one of the meanest. In nothing
was my will [illegible] to submit, as [illegible]
[illegible]. For my part I do profess, & it
will be a mercy [illegible] it. I find,
by God's mercy, my life [illegible] more by
my life [illegible] a more
[illegible] I set my soul in
myself, & have myself in my soul. ...

Chap 10 ... The old woman smiled, "Art thou
a proud stubborn mind like

Quotes from "The Great Chain of Being"
by A. O. Lovejoy. Harvard U. Press. 1936.

p. 7 Of what sort then, are the elements, the primary and prevalent or dominant dynamic units, of the history of thought.

"There are first, implicit or completely explicit assumptions, or more or less unconscious mental habits, operating in the thought of an individual or a generation. It is the habits which are so much a matter of course that they are rather tacitly presupposed than formally expressed and argued for, the ways of thinking and which seem so natural and inevitable that they are not scrutinized with the eye of logical self-consciousness that are most characteristic of the character of a philosophic doctrine, and which flavor most of the dominant intellectual tendencies of an age. These implicit factors may be of various sorts. One sort - a disposition to think in terms of certain categories or

of particular types of imagery.

(2) These endemic assumptions [illegible] Each [illegible] are often of so general and so vague a sort that it is possible for them to influence the course of a man's reflections on almost any subject. A set of ideas which is of a limited type may be termed individual values. You may, namely, find much of the thinking of an individual or a school or even a generation dominated and determined by one or another [illegible] system of reasoning, with its logic, its [illegible] presuppositions which if explicit would amount to a large and important and perhaps highly debatable proposition in logic or metaphysics.

(3) Another type of factor in the history of ideas may be discerned in conceptions of diverse kinds of metaphysical relation. A 'metaphysical relation' is exemplified in any description of the nature of things, any characterization of the world as a whole or [illegible] Some thinkers, like the [illegible] of a poem, [illegible] through their associations and through a sense of impending which they are-

gender, a congenial mood or tone of feeling in the mind of the philosopher or his readers.
E.g. the pathos of sheer eternality; of the nature of the eternalistic pathos; the aesthetic pleasure which the bare abstract idea of immutability gives us; — or the monistic or pantheistic pathos, the voluntaristic pathos

p. 17 (4) philosophical synonyms — a study of the sounds, words and phrases of a period or a movement, with a view to clearing up of their meanings, intrigues, a tracing of their various shades of meaning, ——

5

"Second. Any word or idea which the historian thus isolates for root study is found to have many more than one — sometimes, indeed, many dozens — of the positions & settings in which it figures in any important degree. "

"Space and Spirit" by Sir Edmund Whittaker, F.R.S., Thomas Nelson & Sons 1946 London & New.

Notes from "Space and Spirit" by Sir Edmund Whittaker 1940 (repr.)

pp 26-27 :- "In direct opposition to Plato, who held that the deceptions of sense justified scepticism of sense-information (ἀπατῆς μεστὴ ἡ διὰ τῶν ὀμμάτων σκέψις), and made intuition the ground of all true knowledge, Aristotle insisted in the strongest terms on experiment and observation as the source of our understanding. 'The principles which lie at the basis of any particular science,' he wrote, (Prior Analytics I 30; of De Coelo I 10, II 8; Met I 3, III 1) are derived from experience (ἐμπειρία): thus it is from astronomical observation that we derive the principles of astronomical science'. Essentially a naturalist, he poured scorn on ἀπειρία (De gen. et Corr. I 2) - that is, the state of those who devote themselves entirely to abstract reasoning

from intuitive postulates, and are indifferent to facts. 'Those accustomed to physical inquiries are more competent,' he asserted, 'to lay down principles which have a wide application; whereas others who have been accustomed to many assumptions without the confrontation of reality, easily lay down principles because they take few things into consideration. It is easy to distinguish those who argue from facts and those who argue from notions'. And he insisted on the importance of investigating every subject scientifically (φυσικῶς) – that is to say, by the study of sensible objects in nature (Aristotle), – rather than dialectically (λογικῶς) – that is, by pure deduction from supposed assumptions. It is from sense that we gain the knowledge of particulars; from them by induction (ἐπαγωγή) we discover

the universals in the particulars; and the only concern of science is with universals. 'Let us first understand the facts, and then we may ask for the causes'. (An Post. I 1) ---

§ 11.
Different Kinds of Proof

p. 33 -- "A proof has been defined as a process by which A induces a B because of the justification for a connection. The highest type of proof is the kind that is found in pure mathematics, such as the proof of Sa Gauge's theorem that any number can be expressed as the sum of four squares, or of Gauss' theorem that any prime number of the form $(4n+1)$ can be expressed as the sum of two squares. These proofs depend on no premises

p. 34 whatever, except such logical propositions, which are universally accepted as the necessary presuppositions of reasoning;

they constitute, therefore, incomplete demonstrations which have a coercive power over the minds of all sane persons. It is evident that proofs of the existence of God cannot belong to this class. For if a coercive proof could be devised, it would doubtless have been discovered before now, and would have convinced all those able philosophers among our contemporaries who do not in fact accept any of the proofs hitherto put forward.

"The proofs of assertions regarding the results of scientific experiments, such as the statement that water is composed of hydrogen and oxygen, are of an entirely different character from those of pure mathematics. The proof of the former class involves an extension into the external world, and depends essentially on the principle that experiments such as those of compounding and dissociating water can be repeated as often as we like at different

locations in space, and different instances of time, and that in the past they have always given the same results; whence, on the ground of a belief in the regularity of nature, we conclude that the event happens invariably. Evidently no proofs of the existence of God can be facts of this type.

The process by which a schoolmaster induces in his pupils the belief that Julius Caesar invaded Britain in B.C. 55 are obviously of a different character

p. 34. again, the ~~credibility~~ credibility of testimony now being prominent. Although theological statements may be established by arguments which involve the credibility of testimony, such arguments belong to the domain of morals rather than of natural religion, and so are of no relevance for our present purpose.

§ 12.

Preliminary Comments on the Five Ways

"St. Thomas' proofs of the existence of God cannot be opposed to any of the types we have mentioned. Their most obvious characteristic is that the starting point from which they proceed lies in experience; they take for granted the existence of the external world, and are grounded in Nature. To this indeed was chiefly due their great importance for the history of religion. The Five Ways are not of Christian origin: they are all to be found substantially in either Plato, or Aristotle, or the Stoics, or Maimonides; and St. Thomas, in reproducing the arguments of his Pagan and Jewish predecessors, made little or no change in them. But his rejection of St Anselm's ontological proof in favour of the Five Ways marked a great

and wholesome revolution in the Christian outlook, a new orientation towards the external material world, a recognition of the creation as the primary evidence of the Creator. The long night of Neoplatonism was now ended, and the contempt of matter was a thing of the past.

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"The arguments depend fundamentally on the recognition of connexions between events, which make it possible to arrange them in chains or sequences, such sequences leading up to, and terminating in, God. In the formation of the sequences, the principle of causality plays a ruling part. St. Thomas' thought is dominated by the Aristotelian idea that behind all phenomena there are causes which are knowable entities. Nature is conceived as held together

by claims of causations which are suspend-
ed, so to speak, from the divinity. The
concept of 'cause' has been greatly modi-
fied since Aristotle's time, and his
notion of it has been replaced in
modern physics by the concepts of
mathematical law and predictability;
the repercussions of this changed situation
on natural theology will be postponed
for the present, and taken up later.

"Next, we notice that the last step in
each proof depends on analogy. The principle
that when two things show parallelism in
some respects, we may be justified in attributing
to the one of them something which we know
definitely of the other, and which is associated
with the respects in which there is parallelism.
Analogy is of fundamental importance in the
system of St. Thomas. Thus in the Fifth
p.37 Proof, the order and harmony of the universe
are adduced as showing that nature is
tending towards the fulfilment of a purpose;

and this is so exactly parallel to the tendency of material bodies to seek their proper place that we are led by analogy to ascribe to nature a φύσις similar to the φύσις of material bodies.

"Analogy, like induction, is essentially an inference from sampling; there can be no absolute certainty in an argument which infers the existence of unknown entities from the mere fact of the existence of certain other entities. In practical life, however, an inference from sampling can very often afford be a reasonable ground for belief and action.

"It is evident that principles such as those of causality and analogy carry us beyond direct observation and experiment, and belong rather to the ontological and transcendental domain - to metaphysics, in fact; and this explains why the proofs have no common character; it is because there is no general agreement on questions of

metaphysics

"Another general remark that may find a place at this stage - that proofs must be relative to an axiom and conditioned by it. This remark applies even to the proofs of theorems in pure mathematics, which, as we saw, depend on the formal assumptions;

38. for even those assumptions, namely the fundamental principles of logic, are liable to change. In recent years they have been challenged in an important respect by the work of Brouwer, of which some mention may be made here. At the base of the traditional logic there is the 'Principle of the Excluded Middle', which asserts that either a proposition or its negation is true. Brouwer ~~objects to~~ subjects the word 'true' to a critical examination, and decides that unless there is some imaginable means of ascertaining whether a concept is true or not, the concept of its truth serves no useful pur-

pose, and therefore the only connotation of the word 'true' which deserves to be claimed is that of 'verifiable'. Consequently, a proposition is not to be called 'false' when its negation is a verifiable principle. ----- The stark antithesis of the old 'true' and 'false' does not adequately represent the possibilities that should be recognized and distinguished in the logic of propositions. For such a proposition, therefore, the Principle of the Excluded Middle should not be postulated; and, as Brouwer and his disciples have shown, a satisfactory system of logic can be constructed in which it is not assumed. This 'three-valued logic', as it is called, has recently been shown to be of the greatest value in resolving the paradoxes of quantum-mechanics. What seems to our generation to be an unquestionable intuitive principle

p. 34

of logic does not seem to have the character in the opinion of a later generation, which has a wider outlook on what is actually possible in the cosmos.

"At this point we may say a word regarding the objections which have been brought against the Proofs by mediaeval and modern writers, assuming the character of them until later. Some of them do little more than demonstrate the non-cogency of the arguments, without really diminishing their effective appeal, and indeed much of the criticism that has been directed against them by professional philosophers has, I venture to think, misapprehended the nature of their claim to consideration and the object for which they were devised. St Thomas was not an abstract metaphysician spinning cobwebs in vacuo, but a Christian priest whose aim was one of practical apologetics: he set out not to provide

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demonstrations of this same coercive quality in those of mathematical theorems regarding numbers, but to present arguments of such a character that a man would be reasonably justified in acting on them. ---

p 102. "In Einstein's conception, space is no longer the stage on which the drama of physics is performed; it is itself one of the performers; for gravitation which is a physical property, is entirely controlled by curvature, which is a geometrical property of space. --- The changes of position of the particles, in their turn, may react changes in the curvature of space, so that the particles and space together may be regarded as a single system, whose evolution is determined by the law

that the total curvature of space-time is to be a minimum; as we may say, gravitation represents a continual effort of the universe to straighten itself out: a statement completely unintelligible until it would certainly have been telephoned the words of the Koran.

p. 106. "The importance of this discovery (that Einstein may from me about to make without knowing understanding you) lies in that it modifies the presupposition of the whole Cosmic. Newton teaches: it knows that there are events in the physical world which cannot be represented on the background / space and time." (Bahá'í Sec.

Get a copy of 'Paradise' for 'Elements of Theology' - Can only be a very short summary of the doctrine of Neoplatonism

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Quotes from a paper by Simone Morgan called "The World View of the Galilean".

... "That a strikingly modern world view did exist in Jesus' day is evident from what we know of the writings of Democritus and from the writings of Lucretius. There was had more in common with present-day thought on the structure of matter and the nature of the material world than had any man of science in the two thousand years between. While in philosophy and in politics the intervening centuries added little to the best Greek thought available in educated men of Jesus' day. For example, the world view of Karl Marx scarcely went beyond that of Democritus.

The image of Jesus has been disputed as having almost solely a Hebrew background. Seen from that point of view, it is inadequate. But also disputed from the point of view of its wider sources of origin it may be seen to embody the best of Greek, as well as

of Hebrew thought, and in general to have the characteristics demanded by present-day science and philosophy.

"The prevailing thought about Jesus - based upon the assumption that his background was that of a secluded Jewish village. But as studies have worked out that assumption inaccurate. The population there Jesus lived was as much a Greek as it a Jewish world. In the lands bordering the Mediterranean Sea Greek civilization could no more be avoided than can scientific thought today. Growing up in Nazareth a student had three miles from Sepphoris the capital of Galilee and but twenty miles from a Mediterranean seaport. Jesus lived within twenty-four miles of eight cities with strong a dominant Greek culture among them the great Greek city of Scythopolis and Gadara, home of Meleager, Syria's greatest poet. Then in him in Galilee lies an utterly new

London at the time of Shakespeare or Cromwell.

"Tributary villages like Ngarelik were common a few days. Even today workmen from the village on the side of mount Sapphire walk to work in Ngarelik. Sapphire was discovered when Jerre was about ten years old, but was finished already. His father taught my father how one of the engravers on Ngarelik work.

"The Jerre live in the cultural homeland Cabanna to the north and the western valleys. Their exile in Ft. Ft. B.C. had separated them into two major groups, those in the western valleys of Ngarelik culture and those of the coastal valleys of Babylonian, each group being profoundly influenced through the contacts by the surrounding cultures. The central spirit of Babylonian life is Ba'al. The Ngarelik spirit stone, called Ngarelik. According to Edwardian

When we turn from the Jewish dispersion to the East — India — the world we seem to breathe quite a different atmosphere. Despite the tendency all movements to themselves their mental characteristics and tendencies run in the opposite direction from those of the Hebrew. . . . The Jews of the West are known as rationalists. Pharisaism . . . made no secret of its contempt for the publicists. The deep division was not clear cut and united throughout the mental world. It became complete in the subsequent breach between the Christians and Western Jews.

Three hundred years before Jesus the Greeks had conquered the empire which included Palestine and Syria. There is a flowering of Greek culture the great Stoic philosophy and religion came into being most of its leaders speaking the cities outside of Palestine. Greek rationalism & idea. had been established and disseminated by Jews from Rome.

Galilee was taken from Ptolemy Lathyrus by John Hyrcanus and had been under Jewish domination since the second century B.C., and for two hundred years of Jewish rule many Gentiles had been subjected to Roman authority. Consequently Galilee was the common ground of Jew and Jew, and of the Jewish and Hellenistic religions.

"The influence of Hellenism upon the Jewish people gave new form and added emphasis to ideas already expressed by the prophets. It stimulated a profound development rather than a shift in outlook in the religion of Jewish and of the Christian movement; in it Christ was found and the sinner was convicted as a unity in which God was supreme, and yet the individual person was accorded a greater respect than was before in history.

Under this Hellenistic influence the two centuries before Jesus was on R.H. Charles has shown, in many respects continuity of

greater spiritual progress than any we find recorded here in Israel. The historians of this era were not permitted to write on Bible except when it was connected in the of their origin. But the literature of this era which still survives was written probably for the most part in Galilee.

"So profound was the Greek influence in Galilee that E. Bowman, from his thorough acquaintance with both ancient and modern Palestine declared: 'Galilee was Syria's most Semitic province contact with such was almost unknown for the entire Jew ... Christ by choice passed his ministry in the intellectual freedom; not among the rural hicks of a Syrian village, but in the polished streets ... of an urbane ... Greek civilization.' It is probably no accident that all of Jesus' disciples are Galileans, with the

exception of the Judean Judas Iscariot, and that Paul, who understood Jesus better than the disciples, came from Tarsus where, according to Guignebert, he had lived in a milieu entirely ungrounded in the matter and terminology of Stoicism.

"Living at a Greek and Aramaic-speaking crossroads of Mediterranean civilization, Jesus must have known the Greek-influenced Jewish literature in those languages. Scholarship holds that the Greek translation of the Old Testament was then 'the people's Bible,' not merely among the Hellenists, but in Galilee, and even in Judea.' In addition to Hellenistic literature and culture, Jesus had available the best gentile thought of the age. He lived comparatively near the graduate centers of Mediterranean learning at Sepphoris and at Alexandria and among Jews and

Phoenicians. Law was widespread merging of learning with craftsmanship. In Stone Chamblies supported himself by common labor. In greatest of Babylonian tablet had hardly before been supported himself as a wood cutter and Paul as a working tentmaker. Moreover, before the present era science medicine and especially learning had been flourished as they did at this time of Jesus. In his parable Jesus seemed for the sake of the widespread knowledge of the time which included round theories of astronomy geology, geology, physics and evolution surprisingly like those of today.

If we consider modern parallels, we will see the total importance of such influence upon leaders of men. Dr Daniel Fleming got his idea in education partly as a result of a visit to England. In

Chinese nationalist Sun Yat-Sen was
importantly influenced by the American
Revolution by Christianity through the movement,
and Gandhi, although the heart of
Indian nationalism was profoundly influ-
enced by the English Fabian by the
American Thoreau, and by Islamic the
Christian. If we did not know
records of these influences the assumption
that they had not existed would be as
general as has been the similar assump-
tion in the case of Jesus; though in
his case the probability of cultural
interaction is far more compelling than
with Gandhi, Sun Yat Sen or
Gandhi. Seldom in history do civil
rights movements without striking parallels
of wording new and new developments
are almost always products of much
reading and of the challenge of new
problems.

According to an advertisement of a book on liberal judaism, - "Religion has three related parts - ideas, observances and directions for conduct. It is at the same time a system of thought, a form of worship and a way of life. It offers a faith, a discipline and an ethic."

Isolations from Physics and Philosophy by Sir James H. Jeans. Cambr. Univ. Press, 1943.

p. 145. "We have now seen that ~~atomicity of radiation~~ six important consequences follow from the mere fact of the atomicity of radiation, coupled with three well-established facts of the undulatory theory of light that have been mentioned. These are:

(1) So far as the phenomena are concerned, the uniformity of nature disappears.

(2) Precise knowledge of the outer world becomes impossible for us.

(3) The processes of nature cannot be adequately

represented without a framework of space and time.

(4) The division between subject and object is no longer precise; complete precision can only be gained by uniting subject and object into a whole.

(5) So far as our knowledge is concerned, causality becomes meaningless.

(6) If we still wish to think of the happenings in the phenomenal world as governed by a causal law, we must suppose that these happenings are determined in some substratum of the world which lies beyond the world of phenomena, and also beyond our access." --

p. 155. -- "Heisenberg now approached the problem from a new philosophical angle. He discarded all models, pictures and parables, and made a clear distinction between the true knowledge we gain from observation of nature and the conceptual knowledge we introduce when we

use models, pictures and parables. Since knowledge, as we have already seen, can only be measured, so that Heisenberg's results were inevitably mathematical in form, and could not disclose anything about the true nature of physical processes or entities ---

p. .. 175 .. "The physicists of the last century thought that one of the primary concerns of science should be to devise models or draw pictures to illustrate the workings of the cosmos. It was supposed that a model which reproduced all the phenomena of a science, and so made it possible to predict them all, must in some way correspond to the reality underlying the phenomena. But obviously this cannot be so. After one perfect model had been found, a second of equal perfection might appear, and as both models could not correspond to reality, we should have at least one perfect

model which did not correspond to reality. Thus we could never be sure that any model corresponded to reality. In brief, we can never have certain knowledge as to the nature of reality.

"We know now that there is no danger of ever one perfect model appearing — at least of a kind which is intelligible to our minds. For a model or a picture will only be intelligible to us if it is made up of ideas which are already in our minds. Of such ideas some, as for instance the abstract idea of mathematics, have no special relation to our particular world; all those which have met, as we have seen, have entered our minds through the gateways of the senses. These are restricted by our having only five senses of which only two are at all important for our present purpose.

"A detailed investigation of the sources of our ideas has shown that there is only one type of model a picture which could be intelligible to our retarded minds, namely one in mechanical terms. Yet a review of recent physics has shown that all attempts at mechanical models or pictures have failed and must fail. For a mechanical model or picture must represent things as happening in space and time, while it has recently become clear that the ultimate processes of nature neither occur in, nor admit of representation in, space and time. Thus an understanding of the ultimate processes of nature is forever beyond our reach; we shall never be able — even in imagination — to open the case of our watch and see how the wheels go round. The true object of scientific study can never be the reality of nature, but only our own

observations on volume . -

p. 177 -- "So again, is reality ultimately atomic or is it not? The particle picture tells us of a natural world in which matter, electricity and radiation occur only in indivisible units; the wave picture merely tells us that it knows of none of these things.

"The two pictures seem to tell different stories but we must remember that they are not equally trustworthy. The particle-picture embodies the findings of the old quantum theory which we discussed in chapter V. This proved to be both inaccurate and incomplete, so that the new quantum theory was brought into being to remedy its deficiencies — which it has successfully done. The wave-picture is not only a pictorial representation of the new quantum theory, but also, as regards the mathematical facts involved, its exact equivalent. Thus the predictions of the wave picture cannot be other than true,

whereas those of the particle-picture may or may not be true. When there is a conflict, the evidence of the wave-picture must be accepted, while we may be sure that the conflict results from some imperfection of the particle picture. --

189. " The main difference between the old mechanics and the new is, however, once more a difference of background. The classical mechanics and the old quantum theory had both assumed that the whole world existed in ~~space and~~ time and space; the new mechanics is most simply expressed in terms of symbols which are best interpreted by passing beyond space and time) In transcending space and time, the new quantum mechanics finds a new background which makes for far greater simplicity and so probably comes nearer to ultimate truth.) In passing from the old mechanics to the new, the mathematical description of the pattern of events stands almost unaltered, while the interpretation we put upon the symbols is utterly changed.

§ 192. --- "So long as we are concerned only with our sensations, it is all the same whether we regard the world as a mental construct or as having an existence of its own independent of mind — the essential point at the moment is that it cannot be a private mental construct of our own.

Appearance and Reality

"The doctrine of materialism asserted that this space, time and material world comprised the whole of reality; it regarded consciousness as only a minor incident in the history of the material world, a somewhat exceptional episode in the haphazard muddle resulting from the chaotic movements of photons, electrons and matter in general. It interpreted thought as a mechanical motion in the brain, and emotion as a mechanical motion in the body. It seemed at one time to receive substantial support from science. For consciousness was never experienced except in conjunction with matter; a man's mental state was obviously influenced by the

food, drink and drugs given to his body and many thought it possible that all mental activities might be elucidated in terms of various physico-mental processes occurring in the associated body. At the same time astronomy was finding that only an inconceivably minute fraction of space provided any possibility for the existence of the kind of life we know, and it seemed impossible that the rest of the universe should contain anything but inanimate matter. It was hard to imagine that consciousness should be of fundamental importance in such a world.

"The new physics suggests that, besides the matter and radiation which can be represented in ordinary space and time, there must be other ingredients which cannot be so represented. These are just as real as the material ingredients, but do not happen to make any direct appeal to our senses. Thus the material world as defined above constitutes the whole world of appearances, but not the whole world of reality; we may think of it as forming only a cross-section of the world of reality.

"We may picture the world of reality as a

deep-flowing stream; the world of appearance is its surface, below which we cannot see. Events deep down in the stream throw up bubbles and eddies on to the surface of the stream. These are the transfers of energy and radiation of our common life which affect our senses and so activate our minds; below these lie deep waters which we can only know by inference. These bubbles and eddies show atomicity but we know of no corresponding atomicity in the currents below.

"This dualism of appearance and reality pervades the history of philosophy, again dating back to Plato. [Description of his parable of the cave + shadows] -- For the captives in the cave, the shadows constitute the whole world of appearance. The phenomenal world. While the world of reality lies forever beyond their ken.

"Our phenomenal world consists of the activities of matter and photons; the theatre of this activity is space and time. Thus the walls of the cave in which we are imprisoned are space and time; the shadows of reality which we see projected on the walls by the sunshine outside are the material particles which we see moving against a background of space and time, while the reality outside the cave which produces these shadows is outside space and time.

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"Many philosophers have regarded the world of appearance as a kind of illusion, some sort of creation or selection of our minds which had in some way less existence in its own right than the underlying world of reality. Modern physics does not confirm this view; the phenomena are seen to be just as much a part of the real world as the causes which produce them, being simply those parts of the real world which affect our senses, while the space and time in which they occur have the same

sort of reality as the substratum which orders their motions. The walls of the cave and the shadows are just as real as the objects outside in the sunshine.

"As the new physics has shown, all earlier systems of physics, from the Newtonian mechanics down to the old quantum theory, fell into the error of identifying appearance with reality; they confined their attention to the walls of the cave, without even being conscious of a deeper reality beyond. The new quantum theory has shown that we must probe the deeper substratum of reality before we can understand the world of appearance, even to the extent of predicting the results of experiment.

"For, whatever may happen in reality, there is no reason why the shadows on the wall should change in accordance with a causal law. There will be many different arrangements of shadows on the wall; these many arrangements will be followed by new arrangements which will be not only be

different in themselves but are likely to produce different shadows on the wall. It is the same with the happenings in the world of appearance; experiments that are precisely identical so far as the phenomena go may produce entirely different results. In this way causality disappears from the world of phenomena.

"It comes back when we explore the substratum of reality, although in a strange new guise. Because we have only complete photons at our disposal, and these form blunt probes, the world of phenomena can never be seen clearly and distinctly, either by us or by our instruments. Instead of seeing clearly defined

195 particles clearly located in space and executing clear-cut motions, we see only a collection of blurs — like a badly focused lantern slide. As we have seen (p. 144) this is enough of itself to prevent us ever observing strict causality in the world of phenomena.

"Each blur represents the unknown entity which the particle picture describes as a

particle, or perhaps a group of such entities. The blues may be pictured as wave-disturbances, the intensity of the waves at any point representing the probability that, with infinitely refined probes at our disposal, we should find a particle at that point. Or again we may interpret the waves as representations of knowledge – they do not give us a picture of a particle, but of what we know as to the position and speed of motion of the particle. Now these waves of knowledge ~~seem~~ exhibit complete determinism; as they roll on they show us knowledge growing out of knowledge and uncertainty following uncertainty according to a strict causal law. But this tells us nothing we do not already know. If we had found new knowledge appearing, not out of previous knowledge but spontaneously and of its own accord, we should have come upon something very startling and of profound philosophical significance; actually what we

find is merely what was to be expected, and the problem of causality is left much where it was." ---

p. 200 -- "For the materialists, space was filled with real particles, exercising on one another forces which were electric or magnetic or gravitational in their nature; these directed the motions of the particles and so were responsible for all the activity of the world. These forces were of course as real as the particles they moved.

"But the physical theory of relativity has now shown (pp 137, 171) that electric and magnetic forces are not real at all. They are mere mental constructs of our own, resulting from our rather misguided efforts to understand the motions of the particles. It is the same with the 'forces' in terms of gravitation, and with energy, momentum and other concepts which were introduced to help us understand the activities of the world -- all prove to be mere mental constructs, and do not even pass the test of objectivity. If the materialists are pressed to

may know much of the world they claim as material, their only possible answer would seem to be: Matter itself. Thus their whole philosophy is reduced to a tautology, for obviously matter must be material. But the fact that so much of what used to be thought to possess an objective physical existence now proves to consist only of subjective mental constructs must surely be counted a pronounced step in the direction of mentalism.

"The gravitational theory of relativity again brings considerations of a new kind into play. It provides an outstanding example of the truth of Einstein's general remark (p. 183) that, as experimental research advances, the fundamental laws of nature become simplified more and more, and, as in many other departments of physics, we find this simplicity residing neither in the physical facts nor in

than pictorial representations, but solely in the mathematical formulas which describe the pattern of events. These seem simple to our minds because they are expressible in the kind of mathematics to which we take naturally, and studied for the pure intellectual interest we found in it before we saw it would help us to understand nature — in brief, in pure and not in applied mathematics. Thus the pure mathematician finds it much easier to interpret gravitation in terms of his science than does the mechanic or engineer. But the pure mathematician deals with the mental sphere, the mechanic and engineer with the material. Thus the astronomy theory of gravitation, because of its close connection with pure mathematics, seems to carry us a bit further along the road from mathematics to mentalism and the same may be said of most of the most

developments of physical science.

"The new quantum theory brings still further features into the situation. We have seen how it puts before us the two pictures which we have described as the particle-picture and the wave-picture.

"The particle-picture depicts the phenomena the ingredients are those of the ordinary picture of the material world, namely matter and radiation existing and moving in time and space.

The ingredients of the wave-picture are wave-like disturbances. Whatever a particle may be in itself, we can never experience it as a point, but if we insist on picturing it as such, then the relative intensities of the waves indicate the relative propensities of supposing it to exist at the various points of space.

"Properties relative to what? The answer is Relative to our knowledge. If we

know nothing about a particle except that it emits all places are equally for it, so that its waves are uniformly spread throughout the whole of space. By experiment after experiment we can contract the extent of the waves, but we can never reduce it to a point, or indeed below a certain minimum; the wave-quantum of one proton precludes this so that there must always be a finite region of wave-disturbance left. The wave is the region depict our knowledge and the manifestations exciting and prevailing.

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Thus the ingredients of the particle-picture are particles existing and moving in physical space, while the ingredients of the wave-picture are mental constructs existing and moving in conceptual space. The ingredients of the particle picture are

material theory of the wave-picture mechanics.

The first complete particle-picture was provided by Newtonian mechanics in conjunction with the corpuscular theory of light. The mechanics supposed that those permanent sources of sensation which we call matter consisted of particles moving in physical space, while the corpuscular theory of light further supposed that the radiation by which our sense-organs are affected also consist of particles. This theory was found not to give an adequate account of the facts of observation, and in due course the corpuscular picture of light was replaced by the present wave-picture. This resulted in complete agreement with the facts of observation so far as optical phenomena were concerned. But, until the two

of relativity appeared, it was not suspected that the ingredients of this picture were purely mental constructs.

"The physics continued to believe that it was studying an objective nature which existed in its own right independently of the mind which perceived it, and had existed from all eternity whether it was perceived or not; this belief was the soil in which materialism had its roots. Physics would have gone on holding this belief to this day, had the electron which the physicist observed behaved as on the supposition, it ought to have done.

"But it did not so behave, and the new position [illegible] was brought to existence to make good the deficit. It discovered that in failing to fit the new problem of mind into the rare pattern of matter as the physical speculation of the particle picture of reality had already

gives place to a wave-picture; it now appears that the particle-picture of matter must also be replaced by a wave-picture. The result was a complete agreement with experiment. In this progress toward the wave, let us notice that each step was from particle to wave, or from the material to the mental; the final picture consists wholly of waves, and the ingredients are wholly mental constructs.

"We must remember that this picture is not a picture of reality. It is a picture we draw to help us to imagine the course of events in reality. Thus we are not entitled to argue that reality is like the ingredients of the picture. Although there is a certain presumption that the laws are not altogether dissimilar in their nature; the pictorial representation does not take us into the mansion of reality, but it does take us to the doorstep. Thus, when it was

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believed that the course of events could be most easily understood in terms of forces and mechanical models, most people thought that the picture or model must be like the reality, and jumped to the conclusion that reality was mechanical in its nature. Before this, when the course of events had seemed to be governed by the caprices and passions of gods and demons, it had been assumed that reality was of a similar nature: we have seen how Hobbes maintained that all things must be full of spirits. And now that we find that we can best understand the course of events in terms of waves of knowledge, there is a similar presumption although certainly no proof, that reality and knowledge are similar in their nature or, in other words, that reality is wholly mental.

"Apart from arguments of this type, we

have no means of knowing the true nature of reality. The most we can say is that the cumulative evidence of various lines of probable reasoning makes it seem more and more likely that reality is better described as mental than as material.

"Even if the two entities which we have hitherto described as mind and matter are of the same general nature, there remains the question as to which is the more fundamental of the two. Is mind only a by-product of matter, as the materialists claimed? Or is it, as Berkeley claimed, the creator and controller of matter.

"Before the latter alternative can be seriously considered, some answer must be found to the problem of how objects can continue to exist when they are not being perceived by any human mind:

There must, as Berkeley says, be "some other mind in which they exist". Some will wish to identify this with Berkeley's "the mind of God"; others with Hegel's "universal or Absolute mind" in which all our individual minds are comprised. The new quantum mechanics may perhaps give a hint, although not being more than a hint, as to how this can be.

p. 204 "In the particle-picture, which depicts the phenomenal world, each particle and each photon is a distinct individual going its own way. When we pass one step further round reality we come to the wave-picture. Photons are no longer independent individuals, but members of a single organization or whole — a beam of light — in which their original individualities are merged, not merely in the superficial sense in which we

individual is lost in the crowd, individuality as a raindrop is lost in the sea. The same is true of electrons: in the wave-picture these too disappear in indistinctness and become simply fractions of a continuous current of electricity. In such case space and time are obtained by distinct individuals, but when we pass beyond space and time, from the world of phenomena to world reality, individuality is replaced by community.

"It seems at least conceivable that what is true of perceived objects may also be true of perceiving minds; just as there are wave-pictures for light and electricity, so there may be a corresponding picture for consciousness. When we view ourselves in space and time, our consciousness are seemingly like separate individuals of an

particle-picture, but when we pass beyond space and time, they may perhaps form ingredients of a single continuous stream of life. As it is with light and electricity, so it may be with life; the phenomena may be individuals carrying on separate existences in space and time, while in the deeper reality beyond space and time we may be all members of one body.

Third, modern physics is not altogether antagonistic to an objective idealism like that of Hegel.

"The new dualism of the particle and wave-pictures is in many ways a reminiscent of the old dualism of Descartes. There is no longer a dualism of mind and matter, but of wave and particle. These seem to be the direct, although almost unrecognizable, descendants of the latter mind and matter [illegible] the wave

~~space and matter~~

spacing mind and the particle matter
The two members of this dualism are
no longer antagonistic or mutually ex-
clusive: rather they are complementary
& we need no longer blame elaborate
mechanisms as Descartes and Leib-
nitz did to keep the two in step,
or one control the other — the
wave control the particle, or in the
old terminology the mental control
the material.

p. 68. --- "We must always remember that this theory [the special theory of relativity, 1905] is a deduction from the observed pattern of events. As the pattern can only be expressed in mathematical terms, this theory of relativity also can only be expressed in mathematical terms. It deals with

manners of things, and not with things themselves, and so can never tell us anything about the nature of the things with the manners of which it is concerned. In particular it can tell us nothing as to the nature of space and time.

"Nevertheless, as it shows the mathematical manners of space and time to be intimately interwoven, it seems reasonable to suppose that space and time must be at least of the same general nature. The distinction which many philosophers besides Kant have drawn, between space and time as forms of perception of external and internal appearance is one which can no longer be maintained in regard to physical space and time, although it can for perceptual space and time. - - - -

p. 69 "As a final remark, science and the scientific philosophies have proceeded for

Continues on the supposition that all objects and all events, and indeed the whole universe, can be arranged in space and time. Quite early science has found that such an arrangement is inadequate. The rays of light, waves of sound, and the various other messengers that bring us information as to the happenings in the outer world may quite properly be regarded as travelling in space and time; such a representation is self-consistent, makes sense, and gives a rational account of our perceptions. But we shall see below that we are hardly free to depict the events which dispatch these messengers or happenings in space and time; such an interpretation does not make sense or lead to a rational view of the universe. We find there is something in reality which does not permit of representation in space and time. There space and

time does not contain the whole of reality, but only the messages from reality to our senses. ---

p. 75. "Eddington's claim that the fundamental laws of physics can be foreseen epistemologically would carry more conviction if he could himself establish any one of them, even the simplest, epistemologically - in other words, if he could show that there would be a logical inconsistency in believing the laws to be different from what they are. This he never does.

"It seems to me impossible that he ever could, for merely to speak of establishing any fact of science by epistemology alone involves a contradiction - sense. Epistemology has only one tool - the syllogism. This is pure logic, and before it can be applied to a scientific fact we must define

N.B.

the scientific objects about which the book is talking. We can only do this by calling upon knowledge which has been obtained empirically. In so doing we pass beyond the realm of a priori knowledge, and the discussion ceases to be purely epistemological. ----

10. "It is in fact necessary to build a bridge between the deductions of epistemology and the actualities of observed phenomena; without this epistemology is left up in the air, and cannot know what it is talking about. Kant did this by admitting his synthetic a priori knowledge. Eddington does it by withdrawing his claim that his a priori knowledge is 'knowledge that we have of the physical universe prior to the actual observation of it'; and writing instead that 'to the question whether it can be regarded as independent

of observational experience altogether, we must
I think, answer: 'no'. But this admission
obviously weakens his position enormously;
his natural laws are no longer foreseen
wholly from epistemological considerations,
p. 11 but only from a mixture — in unknown
and unknowable proportions — of laws and
observation, which means simply observation
combined with sound reasoning. And
surely this is just the ordinary procedure
of all science. Eddington's laws, being no
longer backed by pure epistemology,
must renounce their claims to pure
objectivity, and to a certainty that is
denied to those [laws] that can be
reached only empirically. They become
ordinary scientific laws, obtained
in the ordinary scientific way, and the
only question is whether the mathematics
is right or wrong." — —

p. 92 "Science finds that the qualities of a substance or object depend in part on the intrinsic nature of its constituent parts and in part on the way in which these constituent parts are arranged in space, its physical qualities depending on the mode of arrangement of its molecules, and its chemical qualities on the mode of arrangement of the atoms of which its molecules are formed. ~~this being~~

p. 141 ... after describing two hypothetical experiments "In this way we find that the atomicity of radiation destroys the principle of the uniformity of nature, and the phenomena of nature are no longer governed by a causal law — or at least if they are so governed, the causes lie beyond the series of phenomena we know to us. If, then, we wish to picture the happen-

ings of nature as still governed by causal laws, we must suppose that there is a substratum, lying beyond the phenomena and so also beyond our access, in which the happenings in the phenomenal world are somehow determined. ---

The Principle of Uncertainty

"Of the further consequences which follow from the atomicity of radiation, one is of the utmost importance to physics as a whole, and especially to those aspects of it that are under discussion in the present book. Physics sets before itself the task of coordinating the various sense-data which reach us from the world beyond our sense-organs. If our senses could receive and measure infinitely delicate sense-data, we should be able in principle to form a perfectly precise picture of this outer world. Our senses have

limitations of this sense but these can to a large extent be diminished by instrumental aid; telescopes, microscopes etc exist to make good the deficiencies of our eyes. But there is a further limitation which no instrumental aid can make good. It arises from the circumstances that we can receive no message from the outer world smaller than that conveyed by the arrival of a complete photon. As these photons are finite chunks of energy, infinite refinement is denied us: we have always to take at least one and there can never only a fraction. It is like the picture a child might make by sticking indivisible wafers of colour onto a canvas. We might think we could avoid this complication by using

radiation of infinite wave-length.
For the quanta of this radiation have
zero energy and so might be supposed
to provide infinitely sensitive probes
with which to explore the outer
world. And they do so, so long as
we only want to measure energy, but
a true picture of the outer world will
depend also on the exact measurement
of lengths and positions. For this
long-wave quanta are useless. To
measure a length accurately to within
a millionth of an inch, we must
have a measure graduated to millionths
of an inch; a yard-stick graduated only
to inches is useless. Now quanta of
one inch wave-length are, in a sense,
graduated only to inches, while quanta
of infinite wave-length are not grad-
uated at all. Passing from quanta

of short wave-lengths to quantity of long wave-length only slightly but does not remove the difficulty.

"A rough analogy is to be found in the problem of photographing a rapidly moving object. A sensitized film can record no detail on a scale which is smaller than the grain of the film, so that if we use a large-grained film, all the fine detail of our picture will be blurred. If we try to escape the difficulty by using a film of very small grain, we merely move over from Scylla to Charybdis: the speed of the film is now reduced so much that the picture is blurred through the subject having moved appreciably during the time necessary for exposure. ---

p. 143.

Subject and object

"It used to be supposed that in making an observation on nature, as also in the more general activities of our everyday life, the universe could be supposed divided into two detached and distinct parts, a perceiving subject and a perceived object. Psychology proceeded on various questions because the perceiver and the perceived might be the same subject and object might be identical or might at least overlap. But in exact science, and above all in physics, subject and object were supposed to be entirely distinct so that a description of any selected part of the universe could be prepared which would be entirely independent of the observer or will of the operator

circumstances surrounding Einstein.

"The theory of relativity (1905) first showed that this cannot be entirely so; the picture which each observer makes of the world is in some degree subjective. Even if two different observers all make their pictures at the same instant of time and from the same point of space, these pictures will be different unless the observers are also moving together at the same speed, then and then only they will be identical. Whereas the picture depends both on what an observer sees and on how fast he is moving when he sees it.

"The theory of quanta carries us further along the same road. For in every observation involves the

passage of a complete quantum from the observed object to the observing subject, and a complete quantum constitutes a not negligible coupling between the observer and the observed. We can no longer make a division between the two; to try to do so would involve making an arbitrary division as to the exact point at which the division should be made. Complete objectivity can only be regained by treating observer and observed as parts of a single system; there must now be supposed to constitute an indivisible whole, which we must now identify with nature, the object of our studies. It now appears that this does not consist of something we perceive, but of our perception; it is not the object of the subject-object relation, but the relation itself. But it is only in the small-scale world of atoms

and discloses that this new development makes any appreciable difference; our study of the mass-rigid world can go on as before.

p. 144 "For instance, when an astronomer is observing the motion of a planet in the solar system, it is emitting millions of quanta every second, some of which pass through the telescope of the astronomer and into his eye. By noting the directions from which these arrive, he can follow and describe the motion of the planet across the sky. With the departure of each quantum, the planet suffers a recoil which changes its motion, but the changes are so minute that they may properly be disregarded. But it is different when a physicist tries to follow the motion of an electron inside an atom. He can only obtain knowledge of the internal state of

the atom by causing it to discharge a full quantum of radiation, and we shall soon see (p 146) that the emission of a quantum of ~~radiation~~ radiation is an atom-making event that the whole motion of the atom is changed, and the result is practically a new atom. A succession of quanta may give scraps of information about various stages of the atom, but can give no record of continuous change. In fact there can be no continuous change to record, since every departure of a quantum breaks the continuity.

"For this reason it is futile to discuss whether the motion of the atom conforms to a causal law or not. The mere formulation of the law of causality presupposes the existence of an isolated dynamical system which an isolated observer can observe without disturbing it. The

question is whether he, nothing that such a system is in a certain state at one instant, can or cannot foretell that it will be in some other specifiable state at some future instant. But if there is no sharp distinction between observer and observed, this becomes meaningless since any observation he makes must influence the future course of the system.

"In more general terms, we may say that the law of causality acquires a meaning for us only if we have infinitesimals at our disposal with which to observe the system without disturbing it. When the smallest instruments at our disposal are photons and electrons, the law of causality becomes meaningless for us, except with reference to systems containing immense numbers of photons and electrons. For such systems the classical mechanics has already told us that causality

prevails; for then systems causality becomes meaningless so far as our knowledge of the system is concerned; "if it controls the pattern of events, we can never know it."

Re Free Will and Determinism

p. 204 ..."Although Mr. Average Man may occasionally protest that he is incapable of acting morally or dishonorably, yet in general he would balk to think that he is not free to choose his own course of action at every moment of his life. Thus he likes to think that his own actions are wholly unpredictable, and yet, when they run counter to a wholly unpredictable way, he describes them as mad fools. In brief, freedom in ourselves is a virtue, but in others a vice; freedom is something we possess, but that others do not.

p. 212 ---"If something determines his choice, we are back to determinism; if nothing, he acts from pure caprice, and this leads to a free-will which is neither of the kind we want to find nor of

the kind we feel we do find. We like to imagine that we hold determinism at bay by our wisdom or virtue or foresight and not through a mere random caprice over which we have no control and for which we are in no way responsible. A man who has done a foolish deed may find comfort in thinking that he was the plaything of capricious forces, but not so the man who has been prudent or generous or has put his money on a winner.

"Neither does a capricious indeterminism give us a free will at all resembling that of our experience or imagined experience. If every event were not determined by a sufficient reason, the whole world would, as Leibnitz remarked, be a chaos. A mind endowed with free will of the capricious variety would be a prey to spontaneous and wholly irrational impulses; we should describe it as the mind of a madman;

although in actual fact no madman's mind is
ever quite so crazy. The further psychology
and common sense probe into the question,
the more necessary they find it to accept
philosophic determinism - our acts are deter-
mined by our volitions our volitions by our
motives and our motives by our past. The
psychologist will think of this past in terms
of heredity and environment the moralist in
terms of ethical and spiritual influences
and the physiologist in terms of physico-
chemical activities. But all will agree
that the relative strength of the various
motives is determined by past events so
that a man never chooses for himself;
his past always chooses for him. - - -

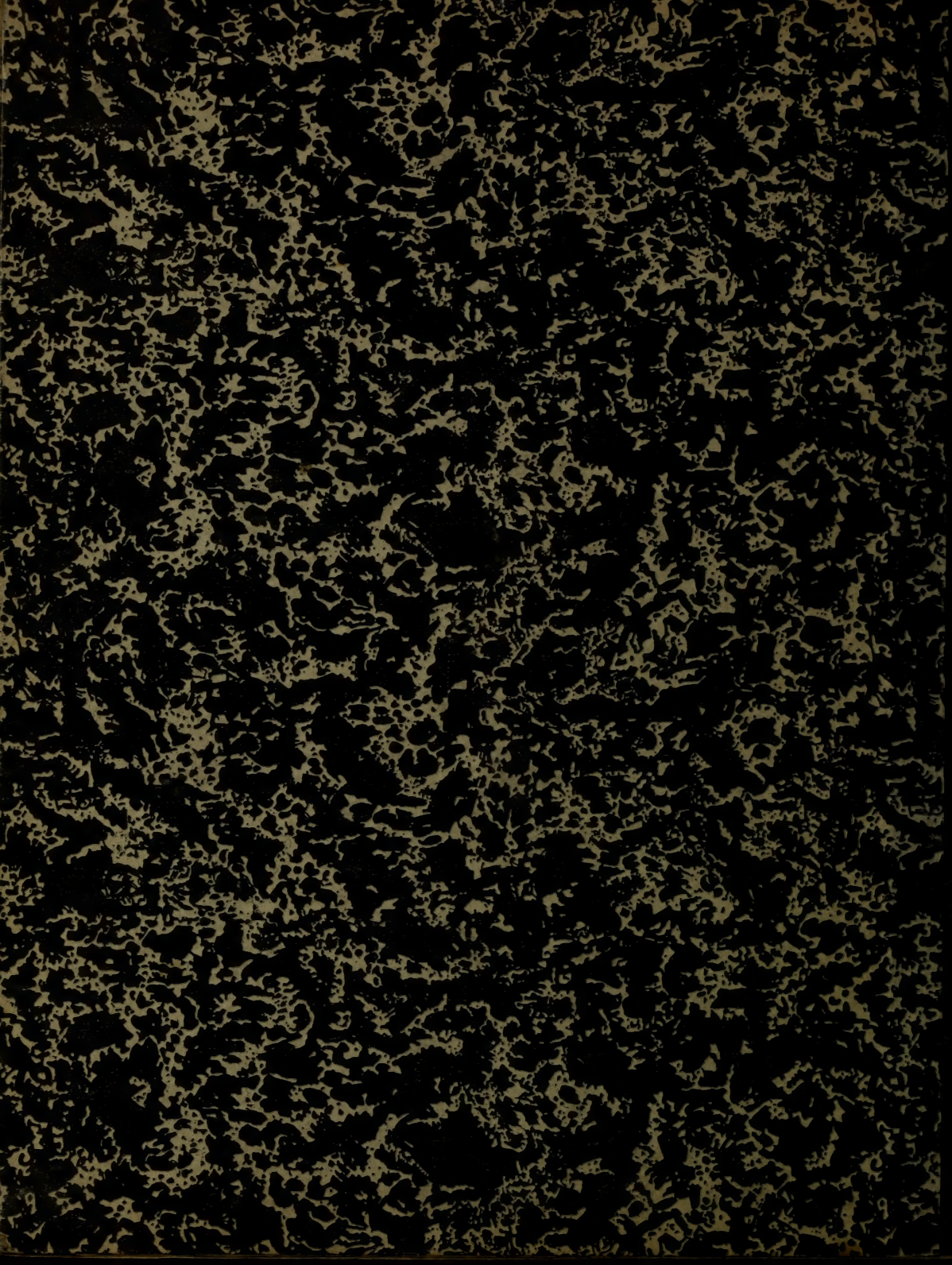
p. 213 "Modern philosophy also seems to have
come to the conclusion that there is no real
alternative to determinism with the result
that the question now discussed is no longer
whether we are free but why we think

we are free. ----

p. 214. --- "Thus free-will is only one name for
--- "many philosophers would agree that
we are able to do what we wish within lim-
its, and so feel ourselves free, but this only
because we do not guess what it is that our
wishes themselves - the springs of our actions -
are thrust upon us by our make. On the
other hand, as we have no immediate ex-
perience of the feeling of freedom in others,
we see that their acts are thrust upon
them by their make, and so regard their
acts as determined. --- Thus, free-
will - only one name for unconscious
determinism. ------

p. 215 "Before the era of modern physics, it was a
simple matter to define what we meant by
causality and free-will. We supposed the world
to consist of atoms and radiation; we imag-
ined that precise positions could be assigned
in principle, to every atom and to every element

of radiation, and the question of causality was simply whether, knowing these positions, it was possible ~~to~~ in principle to predict the future course of events with certainty. The question of free-will was whether it was still possible to predict this course when consciousness and human volitions intervened in the picture.

"But modern physics shows that these formulations of the questions have become meaningless. It is no longer possible to know the exact positions of particles or of elements of radiation, and, even if we could, it would still be impossible to predict what was going to happen next. So far as the universe would be concerned, we may picture a subchaotic below space and time in which the springs of events are concealed, and it may be that the future already lies hidden in ~~it~~ irrevocably and inevitably determined, in this subchaos. Such a hypothesis at least fits all the

p. 202 ---